

Solar Path Light Hack

TCIPG

TRUSTWORTHY CYBER INFRASTRUCTURE FOR THE POWER GRID



Solar path lights, similar to those in the photo, use photovoltaic or PV cells, rechargeable batteries, and transistors or other smart switches to produce light at night.

Why are solar panels useful for these lights?

Observe how the light operates. *When does the light come on? What happens when the sun shines on the solar panel?*

MATERIALS NEEDED

- Solar Path Light
- LED
- Copper Tape
- House Sticker
- Wire Cutters
- Tape
- Hair Dryer
- Small Phillips head screwdriver

STEPS

1. Remove the stake and plastic lens, placing it aside.
2. Use a small Phillips head screwdriver to unscrew black plastic bottom. Carefully pry the black plastic away from the solar panel cylinder.
3. You should see a battery and a small circuit board with wires that go through the holder and attach to the solar panel.
4. Use a hair dryer to melt the hot glue on the back of the solar panel, and push the solar panel away from the holder.
5. Two wires connect the solar panel to the circuit board. Clip these wires at a point **halfway** between the solar panel and the circuit board.
6. Push the solar panel out of the top of the holder so it's fully disconnected. Be careful not to disconnect the wire leads.
7. Unscrew the black battery holder from the printed circuit board (PCB).



+ to solar panel

LED

- to solar panel

+ to battery

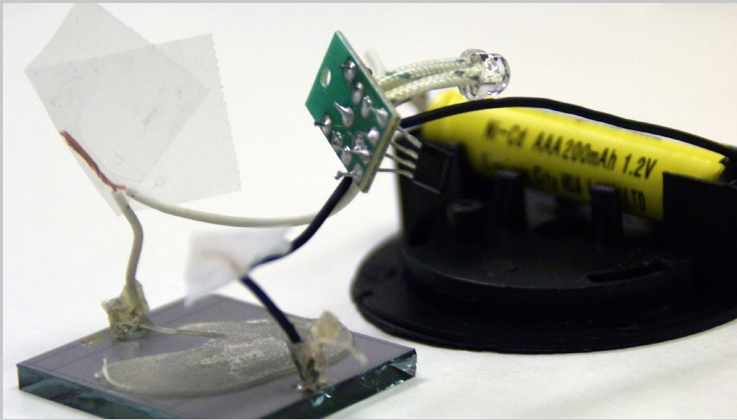
LED driver

- to battery

The PCB circuitry and components control how the path light functions. The LED driver acts like a switch. If the LED driver detects current from the solar panel, it allows the solar panel to charge the battery. If the solar panel is not producing, the battery powers the LED.

Either **the battery** or **the solar panel** could power the LED directly.

What is the purpose of the PCB and its components?



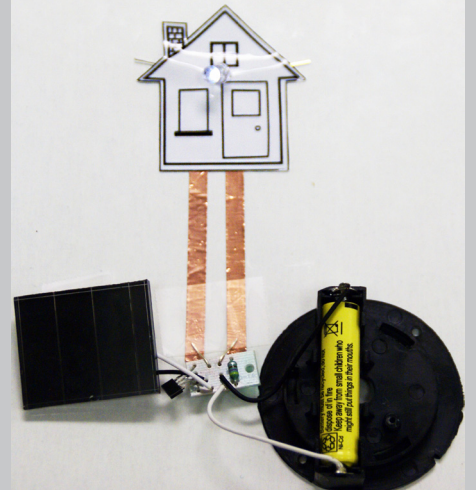
8. Reattach the two wire leads from the solar panel to circuit board leads. Strip the end of each wire and twist together to attach. You can use tape to create a more secure connection.
9. We want to use a different LED, so cut the leads to the LED that is already attached to the PCB. Be sure to cut very near the bulb so the positive and negative leads from the PCB remain as long as possible.

Use the solar panel and battery to power a building sticker.

10. Secure two strips of copper tape to the two leads from the PCB.
11. Use a new LED and punch the positive and negative leads through the house sticker. Tape down sticker such that positive and negative leads are in contact with the copper tape strips.
12. Think of other ways to use solar power and stored power.

When the lights are off, your house should light up!

FINAL PRODUCT



MORE ABOUT SMART SWITCHES

The LED driver in the solar path light may use a **transistor** to direct the current from the solar panel and the battery. Relays are smart switches that use electromagnets to control the switching.

LEARN MORE

Bill Hammack, the Engineer Guy shows the first transistor:

<http://www.engineerguy.com/videos/video-transistor-point-contact.htm>

PBS's Transistorized:

<http://www.pbs.org/transistor/>

Explain That Stuff: Relays

<http://www.explainthatstuff.com/howrelayswork.html>

Explain That Stuff: Transistors

<http://www.explainthatstuff.com/howtransistorswork.html>



John Bardeen
1908 - 1991



Shockley, Brattain, Bardeen
at Bell Labs, 1947

Nobel Prize 1956 - Transistor
Nobel Prize 1972 - Theory of Superconductivity